

ART. IX.—*Notes on the Mode of Reproduction of Geonemertes australiensis.*

By ARTHUR DENDY, D.Sc., University of Melbourne.

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In the paper on *Geonemertes australiensis** which I had the honour of reading before this Society last year, I shewed, by anatomical examination, that in this worm the sexes are not united in the same individual, but that distinct males and females exist. The males, however, appeared to be much less common than the females and the single one which I obtained was considerably below the average size, though, from the insufficiency of the data, it was impossible to found any generalization upon this fact. At the time when I wrote I had made no observations either as to the mode of copulation of male and female or as to the manner in which the eggs are deposited. Relying upon my anatomical investigations, however, I ventured to indulge in certain speculations on these points, which are contained in the following paragraph:—

“The ova, as already stated, grow to a very large size, measuring up to about 0.6 mm. in diameter. It seems to me almost impossible that they should be discharged through the narrow, preformed genital ducts. I believe that they escape by rupture of the body wall and that the ducts merely serve to convey spermatozoa to them. That these ducts do so convey the spermatozoa I conclude from the fact that I have found spermatozoa in them. Probably the process of fertilization is effected by the male crawling over the female and passing out the sperm as he crawls.”†

Since this was printed my friends Messrs. C. C. Brittlebank and H. Giles have collected specimens of *Geonemertes australiensis* and also made some extremely interesting observations upon the method of copulation and egg-laying. I have to thank these gentlemen, not only for an account of their observations, but also for sending me the specimens

* “On an Australian Land Nemertine (*Geonemertes australiensis*, n. sp.)” Proc. Royal Soc. Victoria, Vol. IV, N.S., p. 85.

† *Loc. cit.*, p. 115.

upon which these observations were based, so that, in the case of the egg-laying habits, I was able to continue the observations on my own account. It will be seen in the sequel that my suggestion as to the manner in which the eggs are discharged from the body was incorrect, while, on the other hand, my views as to the method of copulation receive support. The new observations referred to above are as follows:—

On the 22nd of May last Mr. Brittlebank found, near Myrning, two specimens of *Geonemertes*, apparently male and female in copulation. The supposed male was very much smaller than the female, and was riding on the back of the latter. The female was about three-quarters of an inch and the male only about one-quarter of an inch in length when crawling. Mr. Brittlebank observed the specimens for an hour and then posted them to me, but unfortunately they were lost in the post, so that I was unable to determine the sexes by microscopical examination. The notes and sketches made by this careful observer, however, point strongly to the conclusion that the specimens were really male and female. Again, on August 5, Mr. Brittlebank wrote to me that he had found another pair coupled and he adds "the male only crawled over the dorsal surface of the female." Unfortunately these specimens also are not forthcoming for microscopical examination, but Mr. Brittlebank informs me that he watched them for a long time.

The above evidence, though not absolutely conclusive, points strongly to the conclusion that my suggestion as to the manner in which the eggs are fertilized is correct. We have next to deal with the manner in which the eggs are deposited.

On July 4th Mr. H. Giles, of Creekside, Nar-Nar-Goon, found a very fine specimen of *Geonemertes*, which he kept, intending to send it to me alive. He forgot it, however, for some days, and meantime, on July 7th, it deposited a mass of eggs, and on the 13th it was found coiled around a second mass of eggs. On the 15th July I received from Mr. Giles the parent worm and the two masses of eggs which it had laid, the worm apparently in good health, and without any signs of rupture of the body wall, and still containing a number of eggs visible through the integument. I kept this specimen under observation for a long time, and on August 1st found it lying by the side of yet a third mass of eggs which it had evidently just deposited underneath some moss in the

vivarium. The parent animal survived, apparently in perfect health and condition, until September 19th, when I killed and preserved it for future reference.

It will be observed that all these three lots of eggs (which I shall describe presently) were laid by an animal in captivity, and if this were all the evidence forthcoming some critic might perhaps suggest that the laying of the eggs was due to the abnormal conditions of life, as has been suggested in the case of *Peripatus*. Fortunately, however, about the same time two other observers, Mr. Hennel and Mr. Fiddian, found similar masses of eggs in a state of nature, which they kindly brought to me, and which subsequently proved to be undoubtedly eggs of *Geonemertes*. Mr. Hennel obtained his specimen on July 18th, in the damp bark of a gum tree on the Dandenong Creek, and Mr. Fiddian's specimen was found beneath a stone, at Creswick, at the end of July.

The newly deposited eggs of *Geonemertes australiensis* are opaque spherical bodies about 0.6 mm. in diameter and of a white or nearly white colour. Some thirty of these eggs are enclosed together in a sausage-shaped mass of colourless transparent jelly, about half an inch in length, the individual eggs being scattered through the jelly. The surface of the gelatinous matrix is smooth, and the jelly appears to be common to all the eggs, instead of forming a special envelope around each, as in the case of frog-spawn. One such mass of eggs is deposited at a time, and, as is evident from the observations recorded above, at least three can be deposited in succession by the same animal, at intervals of several days, the animal itself remaining perfectly uninjured. Hence it appears almost certain, although the actual deposition of the eggs has not been observed, that they leave the body separately, each by the narrow duct which leads from the sac or capsule containing it to the exterior. This duct, then, appears to serve both for the admission of the spermatozoa and for the extrusion of the fertilized eggs. The source of the gelatinous material in which the eggs are deposited, and also the manner in which the whole mass is moulded into shape, have yet to be discovered. Probably the animal discharges the eggs and pours out the jelly as a secretion from the surface of the body simultaneously. If this were done while the animal was slowly crawling along the result would certainly be one of the curious egg-masses described above. We may compare this hypothetical process with the formation of the slimy

track which under ordinary circumstances the animal leaves behind it when it crawls, only in the latter case the secretion of slime, and consequently the slimy track, are continuous. I do not mean to suggest by this comparison that the gelatinous matrix is identical with the ordinary slime, for that I think highly improbable.

With regard to the development of the eggs my observations have been attended with very little success. The opacity of the embryos, due to the presence of a large quantity of food yolk, renders investigation of them in the living state extremely difficult, and the cutting of sections, which I also attempted, has not so far yielded satisfactory results either. As might have been expected, I have not found any trace of the Piliidium stage so characteristic of some marine nemertines. So far as I can judge at present the development appears to be direct.

On August 26th I examined some of the embryos from the mass of eggs which was found freshly deposited in the vivarium on August 1st. It was easy to distinguish two stages of development. In the first the embryos were spherical and each enclosed in a very delicate transparent membrane. Each was about 0.6 mm. in diameter, opaque and solid-looking, and clothed with short cilia. They revolved slowly inside their delicate envelopes and sometimes slightly changed their shape. In the second stage the embryos had emerged from their delicate envelopes and under the microscope they slowly crawled about, constantly changing their shape in an amoeboid fashion, elongating as they crawled. They were clothed with short cilia and were still perfectly opaque. No eye spots were yet visible.

The next stage observed was in the mass of eggs collected by Mr. Fiddian at Creswick, some of which I examined on August 26th, about a month after they had been found. When removed from the soft, investing jelly these embryos elongated themselves greatly and crawled about pretty freely, much after the fashion of the adult worm. A single pair of eye spots was visible at the anterior end. Microscopic examination, by means of sections and otherwise, showed that the proboscis, alimentary canal and nervous system were all well developed, even the characteristic stylets of the proboscis being present. Hence, although these animals had not yet left the investing jelly, the development was nearly complete. The alimentary canal still contained, however, a very large quantity of unabsorbed yolk-granules.